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July 18, 2018

RE: City of La Crosse
Ebner Coulee Flow Calibration
SEH No. LACRS 142540 14.00

Mr. Christopher Olds, PE
Floodplain Engineer
Wisconsin Department of Natural Resources
101 S Webster Street
Madison, WI 53703

Dear Mr. Olds:

This letter is a follow-up to the December 4, 2017 letter to you which outlined the ongoing Ebner Coulee Floodway FIRM Mapping project, we have included that letter (Phase 2 Wisconsin DNR Submittal Letter.pdf) and its attachments with this submittal for your information. Subsequent to that letter, additional analysis and data collection has taken place regarding the historical rainfall events and resultant flooding in the Ebner Coulee watershed. This letter provides a summary of the historical rainfall model calibration and initial results for discussion and in order to ensure concurrence from the Wisconsin DNR on any future Letter of Map Revision submittal.

SEH has previously discussed the approach of calibrating the modeling to available historical rainfall and flooding data for use in updating floodplain mapping. Based on these earlier conversations, this approach appears acceptable to the Wisconsin DNR. The July 2017 rainfall and resulting runoff event provides for a significant calibration event which we are proposing to utilize as the primary calibration event for the hydrologic and hydraulic modeling for the Ebner Coulee system.

In July 2017, major rainfall and flooding occurred in the La Crosse area, 6.26 inches (as reported at the Weather Forecast Office located about 1 mile from the Ebner Coulee watershed) of rain fell in under 12 hours over the area including the Ebner Coulee watershed.

To collect data for calibration from this event, the city conducted a survey of the citizens living within the Ebner Coulee watershed area. A multiple choice survey was sent to 480 residents; this survey aimed to determine who had flooding on or near their property and who may be able to assist with collection of high water marks. Out of those sent the survey, 163 responded. The vast majority of responses reported that they did not have flooding on their property. There were also a number of “yes” respondents that yielded both anecdotal evidence and elevation surveys of high water marks in several areas. Several respondents also provided photo evidence taken after the flooding. See attached “Survey Example Response” for an example of the survey sent and resulting resident response. Based on this survey several residents were followed up with to assist with collection of highwater marks.

There were two primary areas in the Ebner Coulee watershed in which significant water outside the channel was noted in the survey responses. The first was to the west of the railroad tracks just North of Farnam Street. Based on a discussion with City Maintenance Staff, this flooding most likely occurred as a result of the partial plugging of the Farnam Street culvert that Ebner Coulee empties into. While the plugged condition may have exacerbated upstream flooding, this condition makes model calibration in

this area difficult because the degree of plugging is unknown, making it difficult to recreate in a hydraulic model. Although, it would be fairly safe to assume that upstream flooding is likely greater under a plugged culvert condition than that of unrestricted flow conditions (as is typically assumed in modeling systems).

The second area in which flooding was noted is near Floral Lane just Northwest of the location in which Ebner Coulee exits the confined valley section and enters the channelized raised berm section. Given the available information from the 2017 event in this area, the information gathered for provides useful information for a further refinement in the estimated discharge associated with the 2017 flood event to further calibrate the hydrologic and hydraulic modeling.

Based on information collected, under the 2017 event, the three barrel culvert crossing had two barrels completely plugged and one full open and unrestricted. This caused a significant amount of flow to overtop and travel in the overbanks. The collected field topographic survey outlines the edge of this overtopping flow and is based on interviews of the residents and photographic data. The information collected in this area will be valuable in further refining the model calibration as this project moves forward into the development of a calibrated hydrologic model for support of a LOMR.

Lastly, the many “no flooding observed” type responses to the survey are also useful. As shown in previous work (Figure 4 of “Phase2_Memo_Draft” attached), the 2017 flows obtained from the model calibrated to the FIS flows were mapped with the 1D/2D coupled HEC-RAS model. A number of the

survey respondents who were located within these areas shown as being flooded responded that they did not have any flooding during the 2017 event. If the published FIS values, and therefore the 2017 flood mapping calibrated to those values, were correct, we would have expected to see a significant number of survey responses indicating their properties were flooded; this was not the case.

In summary from all of the information reviewed and collected to date along with our updated hydrologic and hydraulic modeling, it appears that the effective Flood Insurance Rate Map significantly overestimates the flood risk for the study area. This appears to be primarily due to an overestimation of flow rates in the system. Based on a hydrologic model which replicates the Ebner Coulee flow rates given in the Flood Insurance Study, a flow rate of approximately 1000 cfs should have been produced from the 6.26 inch rainfall of July 2017. The highwater marks, reported flooding extents, and damage reports collected from the 2017 event appear that the associated flow rates appear closer to the range of 300 to 400 cfs. Utilizing these calibrated flow values from the 2017 event, we would expect the 1-percent exceedance discharge to be reduced to a range of 450 to 600 cfs. This is a significant reduction from the effective 1-percent discharge of 1,430 cfs utilized to produce the effective FIRM.

LOMR APPROACH

Due to the significance of the potential reduction in discharge rates for the 1-percent event, we propose to include additional detailed calibration analyses moving forward into a LOMR submittal. We have outlined the proposed plan to further calibrate and verify the 1-percent flow in support of a LOMR for the Ebner Coulee area. Prior to moving forward with this plan and spending additional resources, we would like to confirm that the DNR would support a LOMR based on a calibration to the citizen survey information identified above and detailed calibration methodology outlined below.

Detailed Hydrologic Calibration

A HEC-HMS model was made for the area and calibrated to output the published FIS 1-percent peak flow value of 1,430 cfs with an MSE3 distribution with Atlas 14 rainfall depths. This was done with the published drainage area of 0.9 square miles, a copy of the model was made where the drainage area was adjusted to the correct 0.61 square miles draining to the top of the effective model and into the channelized ditch section. The July 2017 rainfall hyetograph was then added to the calibrated model to estimate the expected flow rate assuming the1,430 cfs was the appropriate 1-percent discharge. Other published Atlas 14 rainfall depths were also modeled with the calibrated model to create a plot of return period versus discharge for the system.

Moving forward additional survey is proposed in the area where overtopping occurred near Floral Lane. This would include a topographic survey of the channel and the driveway culverts and bridge crossings.

This additional survey information will be utilized to develop a refined estimate of the "actual" peak flow rate of the 2017 event based on field estimates. We anticipate accomplishing this by creating a detailed SRH2D or RAS2D model of the area in which the overtopping and flooding occurred due to the plugged culverts. This area is chosen for several reasons. First, it is a controlled area where the flow is still fairly contained compared to that of the downstream system. Second, the inflows/contributing watershed area to this location is very clear and well defined. Third, the conditions of the culverts during the storm are known and easy to define in the model. We know from photos that two of the three culverts at the first driveway crossing were plugged. Discharge rates would be modified in the modeling until the resulting flooding approximates the surveyed high water marks. The high water marks are in a relatively flat area, so the flood extents should be fairly sensitive to flow rate changes and thus more easily calibrated.

Finally, the estimated return period of the 2017 storm will be utilized to create a new calibrated HMS model which can adjust the “true” 2017 event flow to the 100 year event, creating a calibrated 100 year flow. This would be the correct 100 year flow at the top of the model. It could be scaled further for the 0.9 square mile drainage area to be consistent with the effective study.

Utilizing the updated peak discharge values, the hydraulic model developed as part of this study, which is a coupled 1D/2D model, would be utilized to estimate the proposed flood inundation mapping resulting from the various frequency events. Due to the regulatory framework, we understand that it may be necessary to develop a fully 1-dimensional model that replicates the 1D/2D results for the LOMR submittal. The developed 1D/2D model is likely a more accurate representation of this system.

Sincerely,

SHORT ELLIOTT HENDRICKSON INC.

Brad T Woznak, PE,PH,CFM
Senior Professional Engineer

btw

Ebner Fact Sheet
Phase 1Technical Report
Phase2_Memo_Draft
Phase 2 Wisconsin DNR Submittal Letter
Survey Example Response

c: Bernard Lenz,PE – City of La Crosse
Lewis Kuhlman – City of La Crosse

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